



Low-Temperature Fuel Cells

at Los Alamos National Laboratory

Fuel cells can produce electricity and heat from hydrogen, natural gas, and petroleum fuels, and fuel gases derived from coal and biomass. What makes fuel cells unique is that they can use fuels without combustion, simply by chemical reactions, making them extremely clean and efficient.

— *National Energy Policy
Development Group Report,
May 2001*

For over 20 years, Los Alamos National Laboratory (LANL) has been engaged in an extensive R&D program in low-temperature fuel cells. The technology focus has been on polymer electrolyte membrane (PEM) fuel cells and on direct methanol fuel cells (DMFCs), but LANL is expanding the scope with a new effort on next-generation alkaline fuel cells (AFCs). These electrochemical energy conversion devices have the potential to radically change energy use with worldwide impact. Fuel cells offer greatly improved efficiency in converting the chemical energy in a fuel into electric energy with reduced emissions of both greenhouse gases and noxious pollutants. When a PEM fuel cell is fueled with pure hydrogen, the only products of the energy conversion are direct-current electricity, heat (often usable for other purposes), and pure water. Hydrogen can be made from a variety of sources, including fossil fuels, or using renewable energy systems. This fuel flexibility enables full utilization of domestic energy resources. The low-temperature technologies being developed at Los Alamos are particularly attractive for applications with multiple start-stop cycles, such as battery replacement, portable power, vehicular propulsion, and residential energy systems. The modular nature of fuel-cell power systems enables distributed, robust generation of combined heat and power. (A more complete introduction to fuel cells can be found in the Los Alamos-developed “Fuel Cells – Green Power” publication on the Internet at <http://education.lanl.gov/resources/fuelcells/>.)

Fuel Cell R&D at Los Alamos

The Los Alamos research program ranges from fundamental investigation of ion transport and electrochemistry to materials development and component optimization. In addition to fuel cells, current R&D includes supporting technologies such as hydrocarbon fuel reforming to generate a

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hydrogen-rich gas stream on demand, gas-cleanup technologies to make such streams compatible with PEM systems, and advanced sensors and controls. Theory and model development further enable knowledge-based innovation. Current research goals include cost reduction and durability and performance improvement. Major sponsors include the Department of Energy (DOE) Office of Transportation Technologies and Office of Power Technologies, the Defense Advanced Research Projects Agency, military commands, and industry. The maturity of this research effort and the multi-disciplinary nature of the Los Alamos National Laboratory, with access to world-leading capabilities and top-notch scientists and engineers in all relevant fields, make this program a unique national asset. Up-to-date program information can be found on the web at <http://www.lanl.gov/mst/fuelcells/>.

This [Los Alamos] effort is doing exactly what the national labs should be doing: leading the way and sharing knowledge.

— Merit and Peer Evaluation,
DOE Fuel Cells for Transportation
Program, June 2000

The Laboratory has worked with industry on fuel cell and related technology since the mid-1970s, through both the government-funded core research program and through cooperative research and development agreements (CRADAs) and licensing. Intellectual Property available for licensing ranges from techniques for cost reduction, to performance improvement, to innovative system

approaches. Los Alamos fuel cell intellectual property is at the heart of several products under commercial development. To find out more about licensing opportunities or options for CRADAs, visit the Internet at <http://www.lanl.gov/worldview/opportunities/>.

Los Alamos Fuel Cell Awards



Partnership for a New Generation of Vehicles Medal, 1998

In a ceremony in the White House complex, Presidential Science Advisor Neal Lane, acting on behalf of then Vice President Al Gore, recognized 15 scientists from the automotive industry, its suppliers, and the Federal government for their work on environmentally friendly fuel cell technology pursued under the collaborative industry-government Partnership for a New Generation of Vehicles (PNGV).



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DOE Energy 100 Award, 2001

This initiative honors 100 of the best scientific and technological accomplishments of the Department of Energy during this century.



DOE Energy @ 23 Award, 2001

Los Alamos Fuel Cells for Transportation were recognized as one of the scientific and technological innovations developed by DOE between 1977 and the year 2000 that demonstrated benefits to the American public, a contribution to U.S. competitiveness in the global marketplace and the potential for significant future growth.

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